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ABSTRACT

During the 1994-95 academic year, a research team at Indiana University expanded the faculty distance education training curriculum to include video vignettes that illustrate instructional techniques used in the regular classroom adapted for distance education settings. This paper summarizes the research literature supporting these efforts and the findings of the researchers. The theoretical basis for the paper is a model that views technological advancement as a series of substitution processes, with change occurring when the new technology is easily substituted for the old. The literature review and preliminary work resulted in informal guidelines for the production of training materials that suggest that a manual and live training can present the basics of technological "button pushing" and that vignettes should include examples of different perspectives and limitations of feedback, as well as examples of use of the document camera. Numerous examples of interaction between students and the instructor and classroom management issues should be given. (Contains 1 figure and 50 references.) (SLD)

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Distance Education Video Vignettes for Training: the Research Foundation

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Presented at the
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Distance Education Video Vignettes for Training:
the Research Foundation

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During the past three years, the research authors have conducted a series of studies to evaluate the effectiveness of distance education technology by assessing student satisfaction with courses offered through the Indiana University School of Education (Pugh and Siantz 1995, Pugh et al. 1994, Pugh et al. 1993). The researchers have also had the responsibility for training faculty who have not had experience using distance education technology. During the 1994-95 academic year this team has been in the process of expanding the training curriculum to include video vignettes which illustrate instructional techniques used in regular classrooms adapted for distance education settings. This paper summarizes the research literature which has directed these efforts and the research findings of the authors.

Recent technological advances in two-way video and audio transmissions have resulted in relatively inexpensive alternatives one-way educational television. The newer technologies can be deployed to create interactive University distance education courses and special instructional sessions. These changes are causing instructors to reexamine "what" and "how" they teach.

Distance education courses using television in the recent past rarely occurred in schools of education, but rather in a different building, across campus in a television studio. Faculty may have done it themselves, we all know faculty who have done it; but

distance education has not been done on a daily basis. Interaction with a community of skilled professionals originally schooled in the tradition of commercial broadcast television was required.

Distance education has changed, but not perceptions. The new era of interactive two-way video and audio transmission and it's accompanying technology has required a paradigm shift. It is now possible to originate a distance education class from a room down the hall from any professor. The system does not require technicians, directors, or scripts, but does require that the professor dial a phone number to establish the connection. Professors are exploring this new medium and testing it. Can you accomplish what you can in your regular class? What are the constraints? What are the possibilities? What works? What doesn't?

Substitution Model

The theoretical basis for this paper is the Substitution Model of Technological Change developed by Fisher and Pry (1971). In this model, technological advancement is viewed as a series of substitution processes, which allow the performance of existing functions or the satisfaction of ongoing needs in a manner different from previous modes. The model illustrates that technological change occurs when individuals can easily substitute a new technology for an existing one. The model is based on three major assumptions:

1. Technological advances are competitive substitutions, a new technology replaces another;

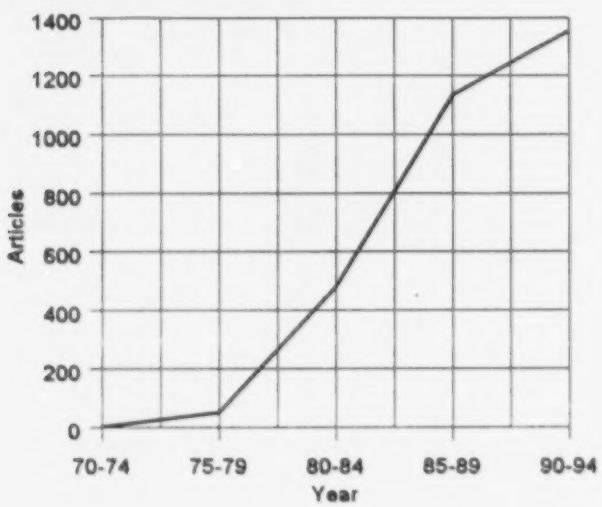
2. If a substitution has been established, it will proceed to completion; and

3. The rate of substitution is fractional to the remaining amount.

Two examples which illustrate the theory are : (1) technological advancements in energy production: the progression from wood, coal, hydrocarbons, fossil fuels, to nuclear fuels; and (2) the advances in the speed of humans: from walking, horseback-riding, automobiles, airplanes, to rockets. Substitutions tend to proceed exponentially, and if the rate is plotted produces an S-shaped curve. Each of the examples illustrate change is the result of competitive substitutions.

In the process of identifying the research related to the development of a training program and video tapes for faculty teaching distance education courses the ERIC databases were searched on a number of criteria. The most global of these searches

Figure 1 Number of ERIC Distance Education Articles in 5 year intervals



produced data that is relevant in the discussion of the Fisher and Pry model. The line

graph illustrated in Figure 1 is a plot of the number of distance education articles in five year intervals. In this case, the top of S-curve is probably misleading, since there is often a delay of one or two years before submission to ERIC. Figure 1 does illustrate the dynamic growth in this field of education. The publications represented by the S-curve, reflect the technological substitutions that have been occurring. There has been progression from technologies represented by correspondence courses, programmed texts, radio, telephone conference calls, audiographics, television to the technologies of television with phone call, two-way compressed video and audio, two-way full-motion video and audio. There are also examples of these technologies supported by Email, FAX, interactive CDs, and the World Wide Web. There has also been an explosion in the machine-human interface designs, effecting the vendor specific controls for operating the equipment and how they are used.

It is still common to view distance education studios as representing one technology, when in fact, as was just described, they are a series of integrated technologies corresponding to various functions. These technologies are the ones continually being replaced in the substitution model. The combination and use of these functions effect classroom interaction between students and the instructor. While there are common denominators as to the use of these functions, faculty have reported difficulty in achieving the "correct" effect when trying to map their instructional style to these new technologies.

There are numerous analogies to this process: knowing VCR functions, versus

knowing how to achieve the desired effect when editing home movies; knowing the basic functions of a computer spreadsheet, versus using the spreadsheet to reflect your method of organizing budgets for research projects; and, knowing the basic functions of MicroSoft Windows versus knowing how to use those functions to your advantage while using SPSS 6.1 for Windows. To a degree teaching is an art, just as an artist who has been working with water-paints, needs to experiment and re-think the desired result when switching to oil-paints, so does the professor when moving to the medium of distance education.

This paradigm shift is a fundamental change. Gehlauf, Shatz, and Frye (1991) state that technologically delivered distance education courses is one of the most significant changes to occur recently in higher education. We are in an era parallel to the massive revolution in desk-top computing in the 1980's. Schmit (1994) states that videoconferencing technology is booming, as is the entire area of distance education as is evidenced in ERIC publication data reported in Figure 1. In the near future, it is projected that systems will be much lower in cost, sales will sharply increase, and systems will be improved. There is a grass roots movement of educators emerging. We are exploring the possibilities of technological substitution applied to our traditional course offerings. What are the implications? Is the quality of instruction maintained? Learning and attitudes of participating students are at a level that it makes no difference whether the course is received in the traditional format or whether it is received in this technological environment.

Thus far evidence has been presented which indicate that the technological

substitution model is germane, that the area of distance education is growing dramatically, and that there has been an impressive amount of publications focused on distance education. In the next section the content of the research literature is explored. Much of the research focused on determining if the new technologies were as effective as regular instruction.

Comparable to Regular Classes?

Numerous studies have addressed the question "Is distance education a viable alternative to traditional instruction?". Most studies have concluded that distance education could be as effective as traditional instruction (Eiserman & Williams, 1987). McNeil and Nelson (1991) conducted a Meta analyses of sixty three research studies addressing the effectiveness of interactive television and established that it can be an effective form of instruction. A report on distance education issued by the U.S. Congress, Office of Technology Assessment (1989) also noted favorable results when examining studies focusing on applications in higher education, business, and the military.

Need for Training

There is a significant body of research literature that indicates that instructors require a different skill set when using a distance education setting. The instructional techniques used by instructors using interactive video are different from techniques used in traditional classes (Carl 1986; Chute, Balthazar, and Poston 1988; McCleary

and Egan 1989). The concern for training instructors for a distance education setting to deal with these differences has emerged as a significant issue (Wood 1990, Chute, Balthazar, and Poston 1988; Haaland and Newby 1983; Johnstone and Kromholtz 1990; Carl 1986; Kromholtz and Johnstone 1989).

There are several specific training issues identified by McCleary and Egan (1989), Ritchie and Newby(1989), Rule and Stowitschek (1991) and Wolcott (1995). The lack of visual cues is problematic, the instructor cannot see the reactions of students. Compensating for spontaneity is also an issue, for it is not as easy for a student to break into a conversation. Instructors must become comfortable with using the document camera as opposed to blackboard. They must begin thinking in a 3 by 4 monitor ratio, rather than the 8.5 by 11 paper ratio. They must sharpen their interpersonal skills, making sure they know the students at the remote sites. More energy needs to be expended in team building activities across sites. Boone and Andersen (1995) re-affirm the need to build a bond with the remote students, but also mention that the instructor is frequently responsible for introducing the technology to students, and training them how to use it. Willis (1994) reacting to this broad area of research and his personal experience identified several major issues for faculty. They include:

1. Significant re-thinking and adapting a current course;
2. Becoming a content facilitator rather than a content provider;
3. Developing proficiency in using the technology as the primary link with students;

4. Compensating for lack of direct eye contact;
5. Understanding and appreciation for the distance education students' lifestyle.

Although faculty need to understand how to use the technology, more important skills involve personalizing the instruction and incorporating student involvement strategies into the instructional experience (Smith 1991).

During the past three years, Pugh and Siantz (1995) conducted a series of studies to evaluate the use of School of Education distance education courses. Data from three courses have been collected using three data sources: observer field notes for each class session, written student comments for each session, and student responses to a survey instrument (Biner, 1993), which was administered multiple times throughout a semester. Results from these three courses have been previously reported. Among the findings were an indication that instructors, while achieving great proficiency with the technical aspects of the studio, experienced mixed reactions with adapting their instructional styles to the interactive-video mode. There was some evidence of more interaction between student and instructor and more interaction among students at the point of origin. The students seemed to be more engaged late in the semester than early in the semester and more engaged at the origin site than at the remote site. These findings are similar to the findings of other researchers exploring the use of distance education technologies. The issues of student interaction and "engagement", are emerging as the significant areas for training and research.

Instructor-Student Interaction

The majority of differences between distance education and conventional classroom learning center on interaction with students and the need to keep the students "engaged" in learning activities. By far the most frequently training need identified focuses on interaction among the students and instructor. Recent publications focusing on distance education applications highlight the importance of interaction . Hillman reports that the need for interaction is so well documented that it is "practically a given" (Hillman et al. 1994). Hillman also cites Shale and Garrison (1990) who state that an interaction among teacher, student, and subject content is fundamental in education. Similar themes have been expressed by several authors including Moore (1989), Wagner (1989) and Wagner (1994).

Since distance education now has "interactive" video and audio features, it is tempting to assume the courses using these technologies will automatically be highly interactive. According to Wagner (1994), "The growing 'folk' acceptance of a causal relationship between the system interactivity and instructional interaction has placed an unrealistic expectation on interactive technologies to ensure that instructional interactions do occur". Stated from another perspective, the newer technologies allow interaction but do not ensure it.

Farr and Muscarella (1991) reported the results of a study comparing the amount of interactivity generated in three different instructional settings: face-to-face instruction in a television classroom, real time instruction via microwave (two-way interactive video), and audio teleconference instruction supplemented with prerecorded

videos. Using a between group design and full motion video transmissions, they concluded that the presence of the instructor, regardless of site, increased the amount of interaction. It was clear that having the instructor in the same room had a positive effect on the quality of interaction

Based on a study that alternated instructors and operating at a bandwidth of a full T1 (i.e., equivalent to 24 phone lines) across sites, Miller et al. (1993) investigated whether interaction with the instructor was curtailed in the remote setting even though the technical capacity for such interaction was available. They also pursued whether students in the remote setting were apt to be as attentive as their "live" setting counterparts. They found that students did not feel that their mastery of the content was as adequate when the professor was in the remote setting as in the "live" setting, a difference that was significant ($p < .01$). A similar result was found with regard to the students feeling a part of the class interaction with the professor.

Ritchie and Newby (1989), using a between group design and one way video two way audio, compared three groups on classroom interaction. One group was a traditional face-to-face classroom, a second group was a studio classroom, and a third group was in a distance education classroom equipped with two-way audio situations. They found that students in the traditional classroom interacted twice as often as the combined total of studio and distance groups. They concluded that distance students experienced less involvement, less ability to ask questions, and less overall enjoyment. They suggested using supplementary strategies to compensate for limitations of the communications systems. However, the context of this study varied from the context of

interactive television.

While the importance of strategies to address student involvement has been well established in the literature (Dillon and Walsh, 1992), instructors tend not to use these instructional activities in the distance education setting. Many instructors use teacher-centered activities in both the distance education setting and in traditional classes. Those instructors who use student centered activities in their regular classes, tend not to use them in the distance education setting (Dillon, Hengst and Zoller, 1991). Instructors in a distance education setting are inclined to teach using student activities less; however, researchers have stressed the importance of fostering interaction with the remote site students (Gehlauf, Shatz, and Frye, 1991).

An interesting perspective on student-instructor interaction was offered by Zhang and Fulford (1994). This study examined a Science Education course to five sites. The results indicate that learner perceptions of interaction time were not correlated with actual interaction time. They concluded that observed or vicarious interaction may be expected to have a stronger influence on student attitudes than overt involvement of individual students. The norm of expecting interaction and relevant interactions are more important than merely devoting time for interactions, and ensuring equal airtime for all students and sites.

One interesting problem related to student interaction, may be attributable to student expectations. Magiera (1994) studied student satisfaction with a managerial finance course from an extension campus to the main campus offered via compressed video. The study found that although student learning appeared comparable on

several measures, students at the main campus had the expectation of having a "live" instructor since they were at the "real" campus. This latter finding was similar to data from other courses at that institution. The authors of this paper also observed similar indications with students at the main campus at Indiana University.

From the literature reviewed, what is known about interaction? It is not automatic, it has to be engineered. Students in the same room with the instructor have the advantage. Conventional classroom interaction is more frequent than distance education classrooms (either instructor site or remote site). The instructor norm for expecting and encouraging student interaction is important, more so than equal time for all students. There is also some evidence that student expectations about the course may influence interactions

Due to the lack of specificity in recommendations for training, the authors examined other areas of research. The majority of the interaction problems appeared to be related to the constraints on visual and auditory feedback (Wolcott 1995) mentioned earlier in the paper. These problems are those of appropriate signal detection. Signal detection theory arose with the development of radar, and emerged as the military developed methods of training personal to detect relevant signals from background signals or "noise". Analogous problems surfaced with early microcomputers. Software engineers were influenced by human information processing theory, a precursor to cognitive psychology, when they designed interfaces for users to access appropriate information. Yearman (1989) describes several annotated bibliographies which substantiate this claim.

Information Processing

The human information processing model is based in part on research which indicated that an adult can maintain 5 to 9 units of information in short-term memory. George Miller (1994) argued that this limitation can be circumvented by organizing the stimulus in several dimensions and developing the information in a series of "chunks". Without repetition or some other instructional activity which allows the individual to relate the pieces of information to other personal knowledge, the new information is lost in 15 to 30 seconds (Miller P. 1993). George Miller stressed the importance of the learner recoding the information. This implies some form of dialog or interaction among the instructor and students. The interaction, repetition or instructional activity assists the individual in the encoding process and movement to long-term storage. Although George Miller's original work was published in 1956, his recognition of the importance of "recoding" of information and the concept of "chunking", is acknowledged as influencing the field of cognitive psychology (Baddley 1994, Shiffrin and Nosofsky 1994).

Aside from the obvious implication for developing class session outlines, 5 to 9 items on a transparency or slide, the human information processing model suggests using a variety of methods and modalities for instruction. The "chunking" of information and the recoding of information, methods used for sequencing, clarifying, reinforcing, and compacting the instructional message, suggested that the instructional design literature be consulted.

Instructional Design

The area of instructional design appears have had considerable influence on the practitioners writing about distance education. Instructional design has been described by Wagner and Reddy (1987) as a systematic method of tailoring theoretical prescriptions for instruction to fit specific application contexts. Siantz and Pugh (1994) describe the extent and variety of practitioner recommendations related to training. They include:

- extensive organization and pre-planning for a course;
- the use of advance organizers or other previewing methods for class sessions;
- the use of visuals for document camera, or computer presentation software;
- keeping segments short; using a variety of instructional activities;
- using repetition and summary; and
- the use of different modalities in instruction.

Reference to instructional design theories are common since they address relevant issues such as encoding and retrieval of information, practice, feedback for confirmation and correction (Wagner 1994, Wagner and Combs 1995, Martin 1994, Wolcott 1995). Fleming and Levie (1978) conducted an extensive meta analysis of research related to instructional design. There were several findings related to distance education. Face-to-face communication is more effective in promoting acceptance than mediated communication, particularly in difficult cases . This

suggests that some form of supplementary instructional activity be physically based at the remote site. Active participation produces more attitude change than passive reception of information). This becomes an argument for going beyond lectures with questions and answers. These authors also address the importance of group discussion, group decision making, and role-playing . More learning can occur where information is received concurrently in two modalities, e.g., vision and audition or vision and touch, than where received in only one modality). A change in stimulation is necessary for sustained sensitivity and normal functioning). Again, themes of involvement and variety emerge.

Many of these themes are elaborated in a model for the integration of video-based instruction developed by Gunawardena (1990). The model begins with goals, objectives, other advanced organizers, class outline, vocabulary lists and continues with participative exercises, questions at end of sequences, summaries, and selected note-taking tasks. Another representative of this genera was developed for compressed video systems by Box (1993). In a review of the literature prepared for the U. S. Department of Education's Star School Program, a public school distance education initiative, Schlosser and Anderson (1994) concluded that the literature appears to confirm that "good distance education pedagogy is not fundamentally different from good traditional teaching technique".

Research on Teaching & Learning

For many years researchers have stressed the importance of variety in

instructional methodology. Rosenshine and Furst (1971) in reviewing research studies related to teacher performance criteria identified five variables related to student achievement: clarity, variability, enthusiasm, task orientation, and student opportunity to learn. They found that student achievement is positively related to classrooms where a variety of instructional procedures and materials is provided and where the teacher varies the cognitive level of discourse and of student tasks.

Brophy (1994) identified teacher behaviors and teacher-student interaction patterns associated with student achievement gains. Teachers who increase student learning gains:

1) emphasized curriculum mastery in establishing expectations for students;
2) allocated time to for activities leading to mastery; and
3) became an effective manager who keep their students on task.

The classical teacher student interaction of factual question by the instructor, answered by student, and followed by instructor feedback correlates positively with student achievement (Ramp and Rhine, 1981). Additional research has also identified the benefit of group activities, reviewing and discussing assignments, verbally encouraging students, and offering corrective feedback when necessary (Stallings et al. 1978). The researchers also identified a factor as a negative correlate - teachers not interacting with student .

Summary and Conclusions

The literature reviewed became the basis for a set of internal project guidelines for the

production of video training tapes. These informal guidelines are presented to assist others in the production of training materials.

1. **Distance Education technology changes rapidly, the "button pushing" aspects of technology can be covered by "live" training and training manual.**

   If one accepts the substitution model, the technology and technology interfaces change rapidly. The technology is often installation dependent. Different sites have different technology. This is either a local training issue, or one that should be addressed by a set of sites having similar technology. The development team at Indiana University chose to handle the specifics of the technical training via in person training and the development of a training manual (Pugh et al. 1994).

2. **Video vignettes should include examples of limitations of visual feedback, and methods to compensate. It is important to illustrate both near and remote site perspectives.**

   In recent years, the common denominator has been video-base technology. Due to monitor resolution, and controls to select close-up views, there is a dramatic difference in the variety and clarity of visual clues available to the instructor. Currently these technologies have low resolution. The detailed is limited regardless of screen size. Higher resolution monitors exist and will become available, but that does not solve the problem of the instructor focusing on a student or of scanning the class in a natural manner. Thus alternatives to compensate for limited

visual feedback need to be developed.

3. **Video vignettes should include examples of limitations of auditory feedback, and methods to compensate. It is important to illustrate both near and remote site perspectives.**

Similar problems exist with verbal feedback. Since it is difficult to make the initial visual connection with the instructor, it is difficult for the student to get the instructors attention to ask questions seek clarification, or recode what the instructor has said into the students cognitive map. The instructor does not have the directional cues of the conventional classroom. Remote site student voice are broadcast over the speakers. It is difficult for the instructor to determine who spoke at the remote site. This problem is compounded with multiple sites, when it is not even clear which site the student is located.

4. **Video vignettes should include examples of when and how to use the document camera.**

The video based technologies have the familiar 3 by 4 ratio of commercial television. This fact in conjunction with low resolution yields several training issues. In general the blackboard does not televise well. The document camera replaces the blackboard. Only the magic number 7 plus or minus 2 fits on the screen. When the document camera is active,

the instructor or student camera is not active. remote students only see what is on the stand, not who is speaking.

5. **Video vignettes ideally should include examples of remote site students with different demographic backgrounds, such as practitioners.**

Instructors are frequently use to having a relatively homogeneous group of students. This is not necessarily the case with distance education courses. Remote site students may be practitioners with considerably more employment experience, than those fulltime students on the main campus. They may vary in age and other demographic characteristics.

6. **Vignettes should illustrate familiar instructional methods and provide examples of good pedagogy**.

Familiar examples of lecture, group discussion, demonstration were suggested by both the Instructional design literature and the research on teaching and learning.

7. **Vignettes should provide numerous examples of interaction among students and instructor and classroom management issues.**

Although interaction is common in most conventional classrooms, fostering this type of environment requires specific professional skills. The challenge was illustrate how the technology could be used to achieve

similar results.

The actual production of the video vignettes involved several stages. Prior to script development he authors produced a series of tables contrasting the a conventional class with a distance education class. The tables corresponded to the major vignettes on the video tape: Lecture, Question and Answer, Demonstration, and Discussion Groups. Each table illustrated what was similar and what was different. The content of each table was derived from the literature described in this paper, and literature which is best described practitioner based experiences.

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